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The Challenge of Change

Why is it human nature to resist change . . . to avoid a new farming practice . . . even though a neighbor may have reduced costs of producing a crop?

With change, often come unfamiliar situations—new challenges to be met.

This magazine was founded to report scientific *change*, brought about through agricultural research. It sometimes reports a change that, even while meeting a major challenge, may create another that then must be overcome.

ARS scientists are very much aware of this. In searching for glandless cotton (page 5), geneticists progressed toward acceptable varieties whose seeds are free of a substance that limits the use of cottonseed products in foods and feeds. But in the process, they discovered that certain cotton insects prefer glandless varieties—over the glanded type. Now they are faced with making their new varieties less appetizing to the insects.

In forage production, research-based practices have for years been recommended that promote thick stands of grass to obtain the best yields. But this may not be desirable for best seed production. Working with intermediate wheatgrass, an agronomist found that keeping grass stands thin maintained higher seed production as the stands become older (page 11).

Horticulturists and nurserymen who adhere to genetics alone in selecting varieties of roses for the largest blossoms will also have to adjust their thinking. An ARS horticulturist has found that by varying the temperature under which a given variety of rose is grown, he can greatly alter the number of petals—and thereby the size—of a blossom (page 16).

Once understood, these interrelationships can often be utilized for the good. By controlling a disease in alfalfa, for example, crops researchers may be able to improve livestock fertility (page 3). Or by eradicating a hopper, entomologists know they can eliminate a disease (page 12).

CROPS

ENTOMOLOGY

FOOD AND HOME

LIVESTOCK

SOIL AND WATER

AGRISEARCH NOTES

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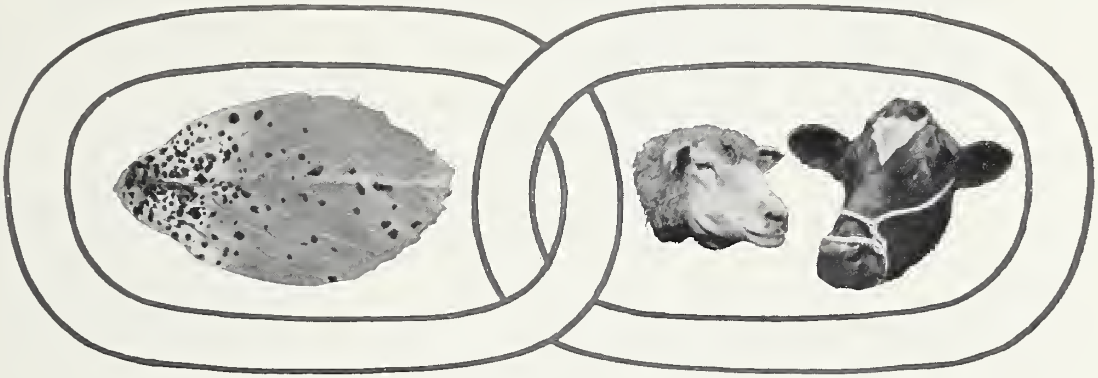


Leafspot and Plant Hormone

Scientists relate alfalfa disease to natural plant estrogen

■ Two commonly occurring leafspot diseases in alfalfa can cause high levels of coumestrol, a natural plant estrogen, in the forage, research by scientists of ARS and the South Dakota Agricultural Experiment Station has revealed.

Stilbestrol, a well-known synthetic hormone, is the source of several estrogens and is used by many livestock producers to bring females into heat and to increase rate of gain in beef animals. Excessive amounts, however, can cause temporary sterility or other reproduction problems.

The effects of natural plant estrogens such as coumestrol are not fully understood. There is experimental evidence that natural plant estrogens have some of the same effects as stilbestrol. Scientists are trying to learn more about these substances in current research.

Even though the new finding leaves many questions unanswered, it contributes to a better understanding of forage quality and will help farmers obtain the most economical production from feeding alfalfa. For example, a farmer will know that moist growing conditions favor disease development and this, in turn, will increase the amount of coumestrol in his alfalfa forage.

Also, ARS scientists say, a long interval between cuttings will favor buildup of disease and coumestrol. This is especially important where forage from nonirrigated fields is chopped and fed green; intervals between cuttings vary considerably because growth is dependent on rainfall. Unless surplus forage can be made into silage or hay, increased production resulting from abundant rainfall tends to delay removal of the next crop and thus increase the incidence of foliar diseases and coumestrol.

Research at Brookings is part of a comprehensive investigation of forage quality coordinated by C. H. Hanson, ARS research agronomist at Beltsville, Md. Previous research, in which ARS cooperated with agricultural experiment stations in California, Iowa, Kansas, Nebraska, North Carolina, Pennyslvania, and Utah, indicated a relationship between environment and coumestrol content. Also defoliation and high coumestrol levels appeared to be related.

These findings led to the research at Brookings, in which ARS-State research agronomist G. M. Loper conducted studies with plants grown in controlled environment chambers.

Loper first investigated the possibility that there might be a relationship between coumestrol level and temperature, phosphorus level, stage of growth, or plant part. He found no relationship; none of the samples in this test contained more than 2 parts per million (p.p.m.) of coumestrol.

This left the possible defoliation-coumestrol relationship still to be investigated. Hanson and Loper reasoned that since diseases are the most

Leafspot *(Continued)*

common cause of defoliation, the possibility of a disease-coumestrol relationship should be investigated.

Loper infected alfalfa plants with two fungi (*Pseudopeziza medicaginis* and *leptosphaerulina briosiana*) that commonly cause leafspot diseases in alfalfa. He found that both infections significantly increased coumestrol levels in forage.

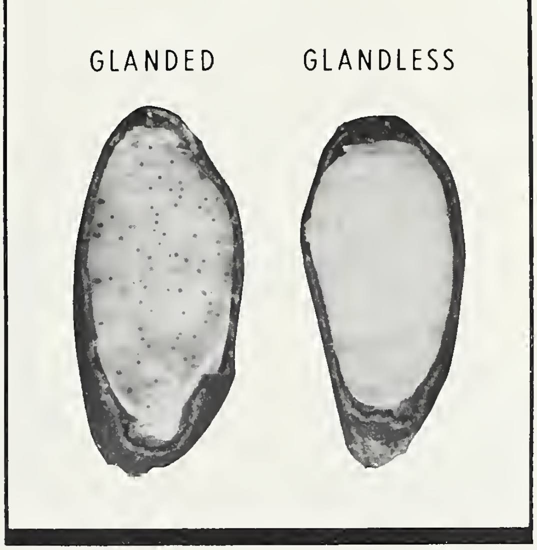
Analysis of the plants infected with *P. medicaginis* showed 183.7 p.p.m. of coumestrol in leaves with two or more lesions per leaflet, 40.4 p.p.m. in leaves with one lesion per leaflet, and 1.1 p.p.m. in the leaves of healthy check plants. No lesions were apparent in the stems, but stems from infected plants had 5.7 p.p.m. of coumestrol compared with 0.6 in stems of the healthy check.

Plants infected with *L. briosiana* had 71.7 p.p.m. of coumestrol in heavily infected leaves, 28.5 p.p.m. in lightly infected leaves, and 7.2 p.p.m. in stems with occasional lesions. Comparable levels in healthy checks were 1.0 p.p.m. in leaves and 0.5 in stems.

The findings suggest that alfalfa forage that is poor in quality because the crop is infected with *P. medicaginis* or *L. briosina* is likely to have increased estrogenic properties, and that good quality forage from a crop free of foliar diseases is likely to have little estrogenic activity.

Hanson says that the significance of the effect foliage diseases have on forage quality should now be assessed. One research need is to study the biochemical processes in which pathogens cause coumestrol synthesis and accumulation in infected plants. Another is to determine how management practices affect coumestrol buildup. It may even be possible eventually to control or regulate coumestrol levels in alfalfa through breeding.☆

Alfalfa leaves infected to this extent by Pseudopeziza medicaginis, a common leafspot organism, contain a high level of coumestrol.



Glandless Cotton

Geneticists rid cotton strains of toxic gossypol

■ ARS scientists report encouraging progress in research to develop acceptable cotton varieties that are free of the darkly pigmented seed glands. These glands contain gossypol, a substance that limits the use of cottonseed products in foods and feeds.

But limited laboratory and field studies show that certain cotton insects prefer glandless to glanded cotton. The scientists are investigating this aspect of glandless cotton development in cooperation with agricultural experiment stations in the cotton growing States, as part of a continuing research program that includes testing for lint yield, cotton quality, and disease resistance.

Must equal commercial varieties

Plant breeders are working to develop glandless cotton that is equal to or better than commercial varieties of glanded cotton. Involved in their research are all of the important U.S. cotton varieties, which account for over 90 percent of the Nation's cotton acreage. Gland-free cottonseed and pollen stocks are available to public and private breeders through the USDA. State agencies are cooperating in the program.

Removal of gossypol is an expensive process, hindering wider use of cottonseed products as animal feed and in foods for human consumption.

Would eliminate extra processing

With glandless cotton, containing no gossypol, cottonseed oil would not require the extra processing and could become more competitive with other oils. The resulting cottonseed meal might become an important source of human nutrition, particularly in countries where a protein shortage exists.

Although the glandless cotton breeding program is centered in the United States, a breeding nursery is maintained at Iguala, Guerrero, Mexico, where private and public breeders from the United States can grow winter generations to speed the research program.

Pollen is available at the Iguala nursery from glandless lines being developed at the Delta Branch Experiment Station, Stoneville. Miss., and at the U.S. Cotton Research Station, Shafter, Calif.

Before a variety of cotton is released for commercial production, it normally is yield tested for a number of years. At several locations glandless lines compared favorably with glanded varieties in yield tests at the Shafter station in 1962. Some of the glandless lines had Verticillium-wilt tolerance equal to that of the glanded varieties. The disease test sites were heavily infested with Verticillium.

Available in early 1970's

Several breeders of glandless cotton plan to conduct yield performance tests in 1964, and most breeders will have conducted them by 1966. They hope to have varieties of glandless cotton available for commercial use by the early 1970's.

A possible deterrent to this goal is the preference shown by some insects for glandless cotton strains. It is not known, however, if this preference, observed in limited studies, will be of major concern when entire fields are planted to the glandless cotton. Entomologists and plant scientists are conducting research to resolve this question.☆

Plant breeders use cotton's own repellant, attractant, and feeding stimulant

Built-In Resistance To Boll Weevils?

■ Plant breeders have looked in vain since the early 1900's for characteristics in cotton plants they could use to develop varieties that are resistant to boll weevils.

Although they have developed early maturing varieties—those that reduce boll weevil infestations until late in the season—breeders have not achieved actual resistance.

Now, ARS scientists have at their disposal dramatic new mechanisms that greatly brighten the prospects. These mechanisms, found through research in recent years, include three chemical substances—a repellant, an attractant, and a feeding stimulant—that affect boll weevil behavior (AGR. RES., September 1962, p. 7, and April 1963, p. 4).

ARS scientists at the Boll Weevil Research Laboratory at State College, Miss., extracted these chemical substances from cotton plants within a few months after the laboratory opened in 1961.

Discovery of the behavior-affecting chemicals gave plant breeders something definite to strive for: plants with high or low concentrations of the chemicals. In the case of the repellent substance, selection of plants would be on the basis of high concentration; in the case of substances that attract or stimulate feeding, the object would be to select for low concentration.

Identifying the genes responsible for the chemical concentrations and mastering the genetics involved in incorporating these genes into commercial varieties will, at best, be a long process. But the possibility of success makes the effort worth while. And scientists at the Boll Weevil Research Laboratory, where research is cooperative between ARS and State agricultural experiment stations in the South, have taken the initial steps.

Plant geneticists J. N. Jenkins and H. N. Lefever and entomologist F. G. Maxwell now head what is informally called the Host Plant Resistance Team. An original member, J. C. Keller, is no longer at the laboratory.

To find the desirable characteristics among hundreds of lines of cotton in germ plasm collections, scientists must have a means of evaluating cotton lines that appear to be promising candidates. So the research team concentrated first on the development of screening and evaluation methods. The team now has techniques for evaluating the feeding stimulant, and the examination of candidate cotton lines for this characteristic is underway. Evaluation techniques have not been established for the attractant and repellant, since satisfactory assays for the chemicals involved are not yet available.

The feeding stimulant, which is water soluble, can be extracted by soaking cotton squares (flower buds) in water. In the evaluation method for this substance, water extract from the candidate line is incorporated into 3 percent agar, the agar is formed into cylinders, the cylinders are wrapped with filter paper, and boll weevils are allowed to feed on the cylinders. The number of feeding holes made through the paper indicate the amount of stimulant in the plant from which the extract was obtained.

The ARS scientists have used this technique to detect variations in the feeding stimulant levels between various species of cotton and between lines of *Gossypium hirsutum* (all but one of the U.S. commercial cotton varieties belong to this species).

Jenkins and Maxwell say that 11 breeder lines of the *G. hirsutum* species appear to be low in feeding stimulant. Two of these have shown consistently low feeding activity through extensive testing; the other

nine lines are now undergoing similar exhaustive tests.

In another approach in the search for weevil resistance, cotton lines are being evaluated for their ability to stimulate egg laying. The number of eggs laid by weevils confined on a cotton line serves as the criterion. In the initial screening, the scientists evaluated 275 lines.

The 26 lines on which the fewest eggs were laid were selected for further testing, and 6 of these were then selected for replicated greenhouse tests. Five of these six lines performed well enough to be field tested this summer.

The scientists say that "if oviposition of these five lines is consistently lower than oviposition on the check variety, the lines will be extremely useful in a breeding program to develop resistant cotton lines."

The Host Plant Resistance Team devised still another technique to evaluate candidate lines for their effect on weevil development. In this technique, research workers prepare a diet containing powdered cotton squares from the candidate cotton line. They then meter the diet into a glass vial, place a boll weevil egg in the vial, and hold the vial at 88° F. and 50 percent relative humidity until the egg hatches and the insect reaches the adult stage.

Criteria for evaluation are the number of days from hatching to adult emergence and the weight of emerging adult. In the initial test in which they used this evaluation, the ARS scientists screened 177 lines. Diets prepared from 17 of these lines produced weevils with low emergence weight when compared with the emergence weight of weevils that were fed a diet from squares of the check variety. Other tests showed that the smaller weevils lay fewer eggs than normal weevils do. These 17 lines are being tested extensively this summer. ☆

Unit Measures Knit . . .

Stretch-Recovery

■ A simple instrument that measures how much knit fabrics stretch—and to what degree they recover their original shape after stretching—has been developed by two ARS textile physicists.

The instrument is inexpensive, easy to use, and can be manually operated. Its accuracy in measuring stretch and elastic recovery is comparable to that of much more expensive electronic equipment now widely used to measure physical properties of fabrics.

A technician measures recovery in a loop of knitted fabric. Readings are noted before weight is added and after removal, then compared.

Hazel M. Fletcher and S. Helen Roberts developed the instrument at Beltsville, Md. They are using it to relate yarn size, stitch length, and loops per inch of cotton and wool knits, to the stretch and elastic recovery. Results are expected to benefit the consumer by helping industry produce improved knitted fabrics for dresses, suits, coats, and other outer garments.

Although the machine is presently being used on knitted materials, it can measure any elastic fabric with a relatively high elasticity, including stretch fabrics.

In using the device (see photo), scientists first make a loop of the material to be tested. They slip the loop over two horizontal bars—one is a stationary arm at the top of a vertical column and the other is a counterbalanced, movable arm. As loads of 1, 3, 5, 10, or 25 pounds are hung on the lower bar, the indicator on the lower bar points to a ruler on the vertical post. This measures the stretch of the fabric.

When the load is removed, the fabric "recovers" and the new reading, when compared with the original unstretched reading, measures the unrecovered stretch. Such measurements indicate how the fabric will behave when used in clothing. ☆

Nesting shelters for...

ALFALFA POLLINAT

■ Alfalfa seed producers in the West have an important ally in the alfalfa leaf-cutting bee, and scientific studies are helping growers make contributions to the alliance.

ARS entomologists G. E. Bohart and W. P. Nye, and extension entomologist G. F. Knowlton of the Utah Agricultural Experiment Station, Logan, cooperated in research on managing the bee, a major pollinator of alfalfa blossoms. Providing proper nesting shelters is an important part of this management.

The alfalfa leaf-cutting bee (*Megachile rotundata* F.) gets its name from its habit of cutting leaves for its nest from alfalfa and some other herbaceous plants. It pays little attention to plants other than alfalfa, sweet clover, Dutch clover, and a few of the wild mints.

This beneficial bee likes to forage within a few hundred feet of its nest. The scientists learned that 20 shelters—each with nesting units that accommodate 5,000 nesting females—are needed to adequately pollinate a 50-acre field. The shelters should be spaced about 400 feet apart.

Alfalfa leaf-cutting bees prefer to nest in darkened, smooth-walled tubular holes, near the place where they emerge. Growers can encourage nesting by placing unoccupied nesting units adjacent to old buildings, for example, where the bees are already nesting. Door and window frames on the east side of unshaded wooden buildings make ideal locations for nesting. Or satisfactory nests can be provided by drilling $\frac{3}{16}$-inch holes in 4- by 4-inch timbers.

A better shelter can be made, however, by cutting $\frac{3}{16}$-inch grooves in boards and matching the boards to form a series of round, tubular holes (see photos). The grooved boards are stacked and bolted or strapped together, closed off at one end with a piece of wood. Grooved boards are more easily inspected and cleaned than drilled holes.

Using boards that were $\frac{5}{16}$-inch

Leaf-cutting bee, its abdomen coated with pollen, trips an alfalfa flower.

LEFT—Nesting unit that is sturdy and easy to clean and inspect is made by cutting $\frac{3}{16}$-inch grooves into boards and matching them to form holes. RIGHT—Bees' nests fill length of groove.

RS

thick, the researchers grooved them parallel with the grain and then cut the boards into 5-inch lengths with a fine-toothed circular saw. Holes deeper than 5 inches usually were not completely utilized by the bees; holes less than 5 inches were less economical in terms of the number needed and the space occupied.

Soda straws in half lengths may also be used as nesting places for the bees, the entomologists learned. The straws, $\frac{5}{32}$-inch in diameter, should be packed into study containers. The half-length straws are more efficiently occupied by the bees than full-length straws.

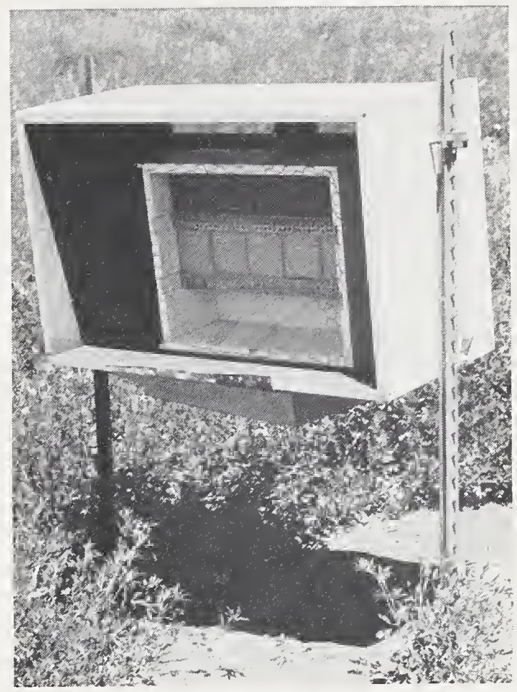
Corrugated cardboard with large grooves (bottle wrap) proved less satisfactory as a nesting unit; it is considered acceptable only when the bee population is exceptionally high. A 6-inch roll of the cardboard can provide at least 600 nests.

The entomologists say that a good shelter should provide an easterly exposure to catch the morning sun and to shield the nest from the noonday and afternoon sun. It should offer protection from wind and rain, and it should have a surplus of nesting holes to allow for population growth.

The shelter should, in addition, be elevated 2 or more feet above the ground, with rabbit wire across the face of nesting units to keep out the birds (see photo). Painting the shelter white helps to protect the nests from excessive summer heat.

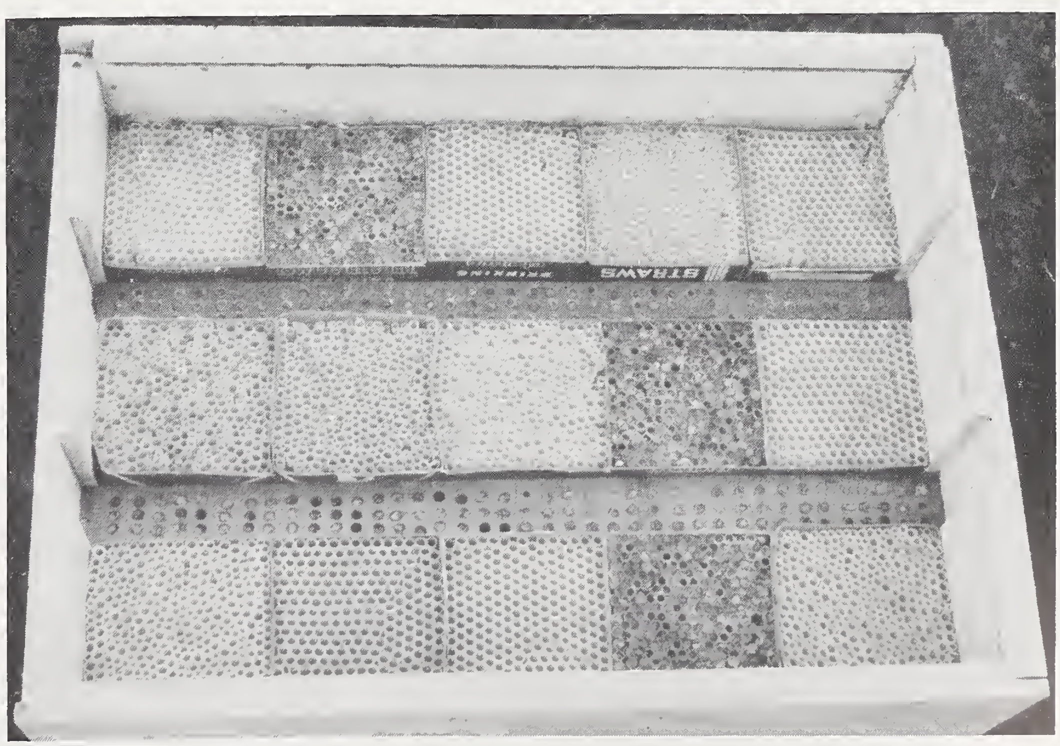
Populations of the bee increase rapidly in June and early July, thereafter remaining quite constant until early September. The bee lives about 2 months.

In October or November, the dormant larval bees may be moved in their nests to an unheated room or cellar. The overwintered bees are placed back in their summer shelters by late April or early May.☆



Simple shelter keeps out birds and shields bees from wind, rain, and hot sun.

Nests in the unit shown below are made by filling cartons with $\frac{5}{32}$-inch soda drinking straws that have been cut in half.



MICROWATERSHEDS

Scientists test miniature watersheds as a means of concentrating runoff

■ Some western areas are now approaching maximum development of surface and underground water sources.

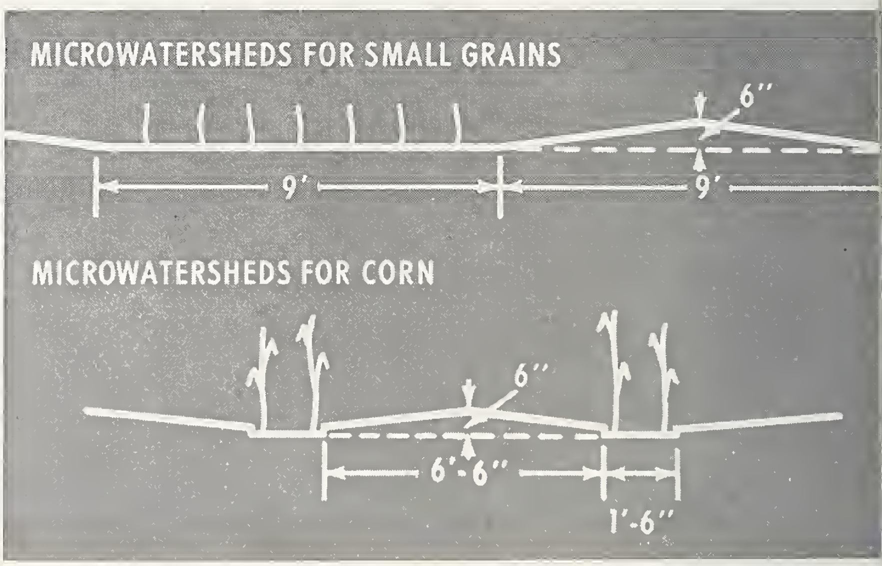
ARS scientists, recognizing the certain need to conserve limited moisture in the West, are developing experimental methods that one day may become practical.

One is a cropping system that concentrates runoff water from an entire field in strips where crops are planted. This method was developed by ARS soil scientist W. D. Kemper, in cooperation with the Colorado Agricultural Experiment Station.

Kemper plants two rows of corn or sorghum in a strip 2 feet wide and spaces the strips 10 feet apart. The 10-foot intervals are ridged like miniature watersheds and are compacted to increase runoff of water to the crop rows.

For small grains, planted strips the width of a drill alternate with compacted ridges of equal width and 6 to 8 inches high. When drought years are anticipated, the unplanted ridges might be extended to three or four drill widths, giving a 3-to-1 or 4-to-1 ratio of water-catching area to cropped area.

This cropping system is potentially more efficient than fallowing to conserve moisture. Kemper says that fallow stores only 12 to 25 percent of the total precipitation from a given year to the next.



Graphic illustrations depict row spacing and contour of the small grain and corn microwatersheds undergoing tests in Colorado.

Experimental plots show corn growing in narrow strips between ridged miniature watersheds. Ridges are compacted or covered with concrete, asphalt, or plastic to divert runoff into rows (see drawing below).

Only half of the land is cropped each year under the experimental plan, just as it is under the prevailing fallow practice, in low-rainfall areas. Alternating equal-width strips of wheat and compacted ridges would keep 50 percent of the land in crops each year. Likewise, the experimental planting of two corn rows for each 12 feet of field width is a 50-percent reduction from the usual spacing of rows 3 feet apart.

Several problems are yet to be solved, including water absorption and weed growth on the ridges and excessive evapotranspiration from crop plants in the isolated rows. Kemper has tried paving the ridges with concrete as a partial solution to both problems. Since evapotranspiration requires absorption of radiant energy from the sun, light-colored concrete should reflect a high percentage of this energy away from the row crop as well as reducing water absorption and weed growth on the ridges.

A similar way of concentrating rainfall involves the use of black polyethylene plastic film to cover ridged soil between 42-inch crop rows (AGR. RES., March 1963, p. 5). In field experiments at Mandan, N. Dak., this method of moisture conservation resulted in corn yields of 50 bushels per acre—even though only 4.2 inches of rain fell during the growing season.

Several proved moisture-saving methods are now available to farmers in low-rainfall areas. These include stubble-mulch tillage, conservation bench terraces, and diverting runoff to level areas or pans (AGR. RES., June 1964, p. 13). ☆

Evaluating soil moisture loss by measuring . . .

Evapotranspiration

■ An experimental procedure that may improve the accuracy of engineers' estimates of water runoff from agricultural watersheds has been developed by an ARS soil scientist. It is based on estimating the moisture loss from soil by evapotranspiration (evaporation from soil and plants plus transpiration by plants).

The amount of runoff depends in part on the amount of moisture lost by evapotranspiration. Precipitation that percolates into the soil, replacing moisture lost by evapotranspiration, does not run off.

These studies by F. R. Dreibelbis and ARS hydraulic engineer Carroll R. Amerman at Coshocton, Ohio, may be useful to designers of flood-control systems and operators of water-storage reservoirs, who need accurate runoff estimates. The Ohio Agricultural Experiment Station cooperated in the tests.

The scientists calculated evapotranspiration loss at various soil depths from data obtained in large outdoor soil tanks called lysimeters. They measured precipitation, surface runoff, soil moisture changes, and moisture percolating below the reach of plant roots. Scientists have no simple, accurate way to measure evapotranspiration directly.

Evapotranspiration is the net result of precipitation, plus or minus changes in soil moisture, minus surface runoff and percolation. The researchers measured soil moisture directly with a neutron meter within predetermined soil layers and devised a method of calculating how much moisture percolated through these layers during an entire growing season. They used the same precipitation and runoff values in all calculations for each soil profile studied to a depth of 72 inches.

The researchers also determined the effects of soil type and farming practice on evapotranspiration.

Meadow, corn, and wheat extracted about the same total amounts of moisture from Muskingum and Keene silt loam soils in lysimeters. The 30- to 72-inch zone in the Keene soil yielded only half as much moisture by transpiration as the zone at the same depth in Muskingum soil because the Keene soil has a compacted layer at 30-inch depth that restricts root penetration.

Another lysimeter experiment demonstrated the effect of farming practices on the water-storage capacity of the soil. Evapotranspiration from meadow managed according to improved farming practices was as much as 4.68 inches greater per growing season than from meadow handled according to prevailing practice. Mr. Dreibelbis explained that roots penetrated deeper under improved management.

He said that although the evapotranspiration values obtained are approximations, they can be used in planning soil and water conservation programs. ☆

Research worker R. K. Walker examines diseased and healthy rice plants at Acarigua, Venezuela.

White Leaf Disease

Scientists evaluate rice for resistance to hoja blanca

■ The threat posed by hoja blanca virus to rice varieties grown in the United States may soon be met with resistant long grain strains.

Selected strains of long grain rice, the result of many generations of breeding, are being evaluated for vigor, straw strength, plant height, reaction to disease, and cooking and processing characteristics.

ARS scientists are working in cooperation with State agricultural experiment stations, and South and Central American countries in this research.

The selected lines are being tested for adaptation to U.S. growing conditions at experiment stations in Louisiana, Texas, Arkansas, and Mississippi. By late fall of this year, enough information should be on hand to determine what selections are suitable for commercial production in this country.

Long grain rice, which has wide commercial appeal, makes up about half of the total rice acreage in all of the Southern States.

Hoja blanca (white leaf) was first found in the United States in Florida in 1957. The virus causes leaves of rice plants to turn a yellowish white, and when infection occurs early, the plants may not produce grain.

The disease is transmitted by a planthopper, *Sogata orizicola* Muir, the only known vector of the virus. The hopper prefers to feed on rice; but under forced laboratory feeding, it has transmitted hoja blanca to wheat, rye, barley, and other cereals.

S. orizicola has been found only in Florida, Mississippi, and Louisiana, appearing in the United States in 1957, 1958, 1959, 1962, and 1963. It has been eradicated each time by ARS plant pest control workers and cooperating agencies.

The insect is believed to arrive on wind currents, but it apparently does not survive this country's cold winters. Should the hopper adapt to U.S. climate, the domestic rice crop then would be seriously threatened by hoja blanca.

More is at stake, however, than disease-resistant rice varieties for use in this country. The United States has a market for seed of long grain rice in Latin America, where hoja blanca is widespread. If U.S. growers are to retain and expand this market, they must have disease-resistant varieties that are productive in Latin America.

Scientists have found that resistance as a genetic character is not difficult to transfer. But many generations of breeding are necessary to develop commercially acceptable resistant lines. When resistance is transferred, undesirable characteristics also are picked up, making the selection of desirable strains difficult.

ARS field trials began in Central and South America in 1957 to determine the reaction of rice varieties and breeding lines to hoja blanca. This work was later extended to the greenhouse at the Louisiana Agricultural

Leaves of rice plants afflicted by hoja blanca virus show typical bleached effect.

Experiment Station, Baton Rouge. All long grain varieties of rice grown commercially in the southern part of the United States, and most widely grown medium and short grain varieties, were found to be susceptible to the disease.

A number of long grain varieties that are resistant to hoja blanca virus were identified in nurseries in Central and South America. But none of them was adapted to the United States. In crossing these resistant strains with U.S. long grain commercial varieties, some resistant lines have been developed that are similar to presently grown domestic long grain varieties in length of growing season, plant type, and cooking characteristics.

Research is continuing in Latin America and at the agricultural experiment stations in Louisiana, Texas, Arkansas, and Mississippi on yield and performance, and in Latin America and in the greenhouse at Baton Rouge on resistance to hoja blanca.☆

Monkey-Faced Lambs...

Chemists isolate lamb-deforming agent from weeds

■ A substance in the poisonous weed false hellebore that causes ewes to produce deformed or "monkey-faced" lambs has been isolated by ARS scientists.

This teratogenic (monster-producing) compound is now being purified and used in studies to learn more about the weed's effects on unborn lambs.

A 250-fold purification of teratogen extract, obtained from false hellebore (*Veratrum californicum*) by chemical means, caused malformations in lamb fetuses under laboratory conditions. The substance is believed to be an alkaloid of the *Veratrum* series, possibly a glycoside or parent alkamine, since its teratogenic potency parallels concentration of these compounds during purification.

R. F. Keeler, chemist at the National Animal Disease Laboratory, Ames, Iowa, is studying the extract, and Wayne Binns, research veterinarian at Logan, Utah, is investigating the plant's effects on sheep. The Logan research is in cooperation with the Utah Agricultural Experiment Station.

False hellebore, also called western hellebore, wild corn, and skunk cabbage, is a showy perennial that grows in 11 Far Western States. The plants range from 3 to 8 feet tall and are relished by sheep. Eight *Veratrum* species (of the lily family) occur in North America.

The toxicity of false hellebore to lamb embryos was reported in 1961, following research by Binns in cooperation with USDA's Forest Service and the Utah and Idaho Agricultural Experiment Stations. For many years, sheepmen believed the "monkey-faced" deformity was caused by a simple, inherited character, but this was disproved about 5 years ago, when Binns was unable to reproduce malformations in a breeding experiment in which "carrier" ewes and sons of "carrier" ewes were mated. The deformity is most prevalent among sheep grazing on some high-altitude ranges during their breeding season.

Recent experiments at Logan provided new and more specific information on the relationship between the stage of pregnancy at which the hellebore is eaten and the effect on the lamb. Ewes produced malformed live lambs if they were fed the poisonous plant on the 13th or 14th day of pregnancy. Eating the plant before the 13th day of pregnancy had no effect on the developing embryo, and continuous daily feeding after the 15th day increased fetal deaths.

Sheep eating a sublethal dose of the plant show clinical signs of intoxication in $2\frac{1}{2}$ to 3 hours and, if left undisturbed, usually make a complete recovery within 3 or 4 hours. A lethal dose usually causes death in 6 to 18 hours.

The effect of the natural teratogen on lambs is very similar to the effect of thalidomide on human babies. In fact, these mammalian deformities were the first documented in epidemic numbers for which the cause is known. (A serious case of hellebore poisoning causes a lamb with one eye in the center of its head. Thalidomide affects limbs of unborn babies.)

The specific effect of the teratogen on the unborn lamb is now being studied to learn why only certain fetus cells are affected.☆

Seeding Ozark Ranges...

Hardwood brush area is converted to productive grazing land

■ Ozark ranges covered with low-quality oak and hickory brush have been converted to productive grazing lands by ARS and Forest Service scientists in cooperative research with the Missouri Agricultural Experiment Station, Columbia.

E. J. Peters, ARS agronomist, and J. H. Ehrenreich, Forest Service range conservationist, first reduced the hardwood brush stands with a herbicide—2,4,5-T. They then seeded some plots with a grass-legume mixture, and other plots with a native grass mixture. A commercial fertilizer—8–24–8—was added to the soil in some test areas.

The grass-legume mixture was made up of K–31 fescue, and Korean and sericea lespedeza. The native grass mixture included little bluestem, big bluestem, indiangrass, and sideoats gramma.

After 3 years, annual forage production increased from less than 50 pounds per acre to about 1,500 pounds per acre with seeded native grasses, and to 1,100 pounds per acre with unfertilized fescue and lespedeza. Fescue and lespedeza fertilized with 320 pounds of 8–24–8 per acre produced about 3,300 pounds of forage per acre. Fertilizing native grasses did not up the yield.

The scientists found that seeding with desirable forage grasses is necessary following treatment with the 2,4,5-T and removal of competition from the hardwood brush. Desirable forage species had usually been depleted by overgrazing so that they could not develop good stands.☆

Higher Forage Seed Output...

Thinning of intermediate wheatgrass helps maintain seed production

■ Keeping grass stands thin may be the key to maintaining high seed production as grass stands become older, if Washington tests with intermediate wheatgrass are a true indicator.

Seed yields of this grass, a vigorous sod former, generally drop rapidly after one or two crops—a pattern typical of many perennial grasses. But ARS agronomist C. L. Canode found that burning stubble and mechanically thinning stands helped maintain high seed production over a 5-year period.

The research was cooperative with the Washington Agricultural Experiment Station.

Canode planted the grass in the spring in rows spaced 3 feet apart. Each subsequent spring, plots were carefully cultivated to remove as little grass as possible. One cultivation was made each September to remove all vegetation extending beyond the average row width of 12 inches, a practice followed to maintain row culture throughout the test.

Each year after seed harvest, stands were thinned by burning or cultivation, or they were left untreated. Stands treated by burning the straw and stubble yielded up to 70 more pounds of seed per acre annually than unburned stands. Removing every other foot of grass in the rows with hand shovels produced the same results. When the practices were combined, treated stands yielded about 130 more pounds of seed per acre than unburned plots.

In the fifth crop year, burned and mechanically thinned plots yielded 446 pounds per acre compared to 339 pounds for unthinned plots. Average yields for the last 4 crop years were 513 pounds per acre for burned and mechanically thinned plots, and 388 pounds for unthinned plots.

Canode points out that thinning by burning or cultivation reduces the lodging so characteristic of this tall-growing plant. Lodging in old stands is one cause of low yields. Thinning stands also reduces competition for moisture.

Canode also treated stands for response to fall application of nitrogen, applying 60, 80, 100, or 120 pounds of nitrogen per acre. He said that increasing the rate of nitrogen above the recommended 60 pounds per acre was not effective in maintaining high seed yields as stands became older.☆

Testing tobacco leaf strength

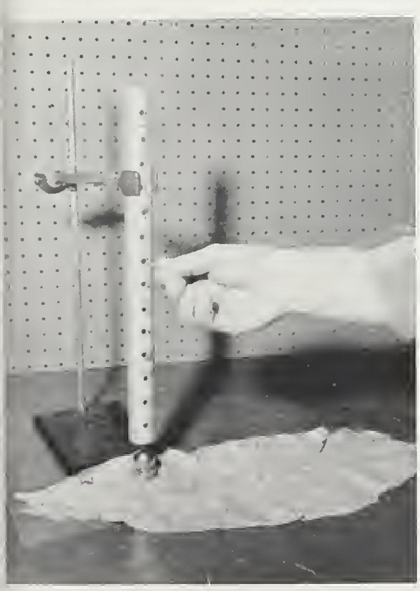
How much punishment can a tobacco plant take before its market value is reduced?

The answer to this question will help ARS and Kentucky agricultural engineers in their development of a machine that harvests burley tobacco efficiently and with little or no loss in market value of the crop. Tobacco is one of the few crops in the United States still produced almost entirely by hand.

Since burley tobacco is harvested and cured on the stalk, a mechanical harvester must be able to harvest the crop without injuring the leaves or breaking them off the stalk.

In basic research underway at the University of Kentucky, Lexington, agricultural engineers J. H. Casada of ARS and S. W. Smith of Kentucky are applying forces, such as bending and twisting, to mature burley tobacco leaves to learn as much as possible about their physical properties.

Engineers drop steel ball from various heights to measure the smallest amount of impact that a leaf can stand before bruising. Damage levels are determined after the leaf is completely cured.



One test is designed to determine how much resistance to bruising the leaves have when static pressures are applied to them. Another test is designed to determine resistance to bruising when impact loads are applied to the leaves. Badly bruised tobacco does not cure properly and its market value is reduced.

The scientists also devised a way to measure leaf flexibility. Leaves on the stalk are bent up, down, and sideways. Casada and Smith found that leaves will bend upward until they touch the stalk without breaking but will not bend too far downward or to the side. If necessary, leaves could be bent upward against the stalk for mechanical harvesting.

Safeguards against poison plants

ARS toxicologists have summarized conditions under which livestock eat unpalatable poisonous plants and practices ranchers should follow to protect livestock against them.

The cost of eradicating poisonous plants would be prohibitive, the researchers say, considering the broad expanses foraged by range livestock. The next best approach, therefore, is one of minimizing the threat by proper livestock management.

Research has shown that almost all poisonous plants are unpalatable, some exceptions being arrow grass, lupine, larkspur, and locoweed. Why, then, do livestock eat the unpalatable types? Toxicologists L. F. James, Wayne Binns, and J. L. Shupe have observed some contributing reasons.

Livestock will eat the unpalatable weeds—(1) if their feed intake is low as a result of overgrazing, drought, trailing, or trucking; (2) if they have perverted appetites resulting from a deficiency of salt, phosphorus, or other minerals; (3) if there is a lack of variety in their normal diet; or (4) because of the tendency of animals to eat anything available immediately after getting water, especially if they have been without water for more than normal lengths of time.

Ranchers can help prevent livestock poisoning if they learn to identify poisonous plants; maintain healthy animals; provide ample feed to prevent overgrazing; and drive or herd animals slowly. They recommend against turning hungry animals on areas infested with poisonous weeds, putting salt in areas that abound with poisonous plants, or relying only on medication.

The toxicologists say that ranchers should also provide ample water; change sheep bed grounds often; try to control poisonous plants in problem areas; and graze species of animals least susceptible to poisonous plants in area. Livestock should be kept off areas where infestations of poisonous plants are the heaviest, or grazing of dangerous areas should be confined to periods when poisoning is least probable.

Not all livestock poisonings are caused by range weeds, the scientists point out.

Oat or other cereal hay, corn, and weeds such as lamb's quarter can contain excessive amounts of nitrate and

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AGRISEARCH NOTES

be toxic to livestock. High nitrate levels sometimes occur if these plants are grown on soils containing excessive amounts of manure or artificial nitrogen fertilizer.

Plants such as rhubarb, lamb's quarter, and sugarbeet tops can be high in poisonous oxalates. And hydrocyanic or prussic acid is produced in such plants as sorghum, sudangrass, Johnsongrass, and arrowgrass because of drought, mowing, frost, or other injury.

Irving assumes new ARS duties

Dr. George W. Irving has assumed the duties of Associate Administrator for ARS, replacing Dr. M. R. Clarkson, who retired July 18.

As Associate Administrator, Dr. Irving shares with Administrator Byron T. Shaw the broad authority and responsibility for managing ARS research and regulatory activities.

Dr. Irving moves up from the position of Deputy Administrator for nutrition, consumer and industrial-use research. He has led research aimed at increasing utilization of farm commodities for nearly 10 years.

Dr. Clarkson's retirement comes after 34 years with USDA, many of them devoted to inspection programs that assure the cleanliness, wholesomeness, and truthful labeling of meat marketed interstate. Dr. Clarkson was named Deputy Administrator for all regulatory programs in 1952 and became Associate Administrator in 1959. He began a term as president of the American Veterinary Medical Association last month.

A rose is a rose . . . by degrees

A rose is a rose . . . the old saying goes . . . but temperature can greatly alter its appearance, research by ARS horticulturist Peter Semeniuk has demonstrated.

Striking variations occurred in blossoms on seedlings of the floribunda rose variety "Ma Perkins" grown at five different constant temperatures in a greenhouse at Beltsville, Md. (see photos, below).

Rose plants grown at cool temperatures (62° and 72° F.) produced more petals and bigger blooms than plants grown at warm temperatures. One plant grown at 62° had blossoms averaging 19 petals. Plants grown at 82° and 92° produced blossoms with five petals, the basic number of the wild rose species.

Rose petals increase from the basic five by the development of stamens into petals; the combined number of petals and stamens remains the same.

52° (17 petals) 62° (19 petals) 72° (11 petals) 82° (5 petals) 92° (5 petals)